



Materials Engineering Branch

TIP*



No. 031 Thermal Greases

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The use of thermal greases is no longer recommended for space flight hardware. In the early years of space flight, there were limited methods for providing thermal conductance between adjacent interfaces. Therefore, engineers resorted to a solution frequently used in ground support systems, namely thermal grease. From the outset, there were problems with this approach. Contamination due to volatility and creep were common occurrences.

For several years, engineers attempted to overcome these shortcomings, first by developing low outgassing products and, secondly, with the use of barrier films to preclude creep. Extreme care must be exercised in the use of these greases in order to minimize the potential for contamination, particularly in ground handling operations.

Most of these greases are of a silicone oil base with metallic oxide fillers. One having among the best thermal conductivity and acceptably low outgassing properties in vacuum at 125°C is Emerson and Cummings' TC-4.

However, as with all silicone oils, these greases have a low surface energy and a tendency to creep or migrate along the surface to which they are applied, depending on the nature of the surface, and other factors. If critical optical or thermal control surfaces are close to such grease, it is conceivable that contamination of them by the grease will occur in time.

The grease can also be transferred from one surface to another via contact. This is more likely to occur during integration and test at the instrument or spacecraft level. Once contamination has occurred, silicone greases are extremely difficult to remove. Solvents such as toluene or "Simple Green" need to be evaluated for substrate compatibility before they can be used.

In time, alternate products have been introduced that have proved more satisfactory. These consist of: 1 - two part thermally conductive silicones and urethanes; 2 - thermally conductive pads (primarily silicone based and less often, graphite-based) and 3 - thin metal foil interface material (typically

indium). Use of graphite-based pads or indium interface foil requires further review to ensure control of particulate generation.

In general, thermal greases should be avoided when other options for thermal energy transfer exist. Refer to TIPs 073 and 119.